CLAIMS

1. A land based seismic data collection unit comprising:

   a. a case having a wall defining an internal compartment;

   b. at least one geophone disposed within said case

   c. a clock disposed within said case;

   d. a power source disposed within said case; and

   e. a seismic data recorder disposed within said case.

2. The unit of Claim 1, wherein said unit is self contained and requires no external communications or controls during recording.

3. The unit of Claim 1, wherein the case is watertight.

4. The unit of Claim 1, wherein the case comprises a first plate having a first periphery and a second plate having a second periphery, wherein the plates are joined along their peripheries by said wall.

5. The unit of Claim 1, wherein said case is defined by at least one substantially flat wall.

6. The unit of Claim 5, wherein said at lest one geophone is disposed adjacent said flat wall.

7. The unit of Claim 1, wherein the case is defined by at least one plate.

8. The unit of Claim 7, wherein said at least one geophone is disposed adjacent said plate.

9. A land based seismic data collection unit comprising:

a. a case having a wall defining an internal compartment;

b. at least one geophone disposed within said case

c. a clock disposed within said case;

d. a power source; and

e. a seismic data recorder disposed within said case.

10. The unit of Claim 9, wherein said unit is self contained and requires no external communications or controls during recording.

11. The unit of Claim 9, wherein the power source is disposed within the case.

12. The unit of Claim 9, wherein the power source includes a fuel cell attached to the case.

13. The unit of Claim 9, wherein the power source includes a solar cell attached to the case.

14. The unit of Claim 1, wherein the wall is non-spherical.

15. The unit of Claim 1, wherein the wall is non-hemispherical.

16. The unit of Claim 1, wherein the case defines an external surface, and the external surface is provided with ridges to enhance coupling of unit with the earth.

17. The unit of Claim 16, wherein the case defines an external surface, and the external surface is provided with at least one spike to enhance coupling of unit with the earth.

18. The unit of Claim 1, further comprising

a. three geophones disposed within said case; and

b. a compass.

19. The unit of Claim 1, further comprising

a. a tilt meter disposed within said case.

20. The unit of Claim 1, further comprising a GPS location transducer.

21. The unit of Claim 1, further comprising a radio unit.

22. The unit of Claim 1, wherein said clock is a crystal clock.

23. The unit of Claim 1, wherein said clock is a rubidium clock.

24. The unit of Claim 1, further comprising an external connector in electrical communication with at least one of said geophone, clock, power source and seismic recorder, said connector extending through the wall of said case and disposed within said wall so as to be set in from the external surface of said wall.

25. The unit of Claim 24, further comprising a water tight, pressure resistant cap disposed over said external connector.

26. The unit of Claim 1, further comprising a radio frequency identification.

27. The unit of Claim 1, wherein said power source provides all power to the unit while deployed.

28. The unit of Claim 1, wherein said power source is a lithium-ion battery.

29. The unit of Claim 1, further comprising an internal control mechanism for controlling all functions of the unit while deployed.

30. A seismic data collection unit comprising:

a. a case; and

b. a rubidium clock disposed within said case.

31. The seismic data collection unit of Claim 30, wherein said at least one geophone is disposed within said case.

32. A seismic data collection unit comprising:

a. a case;

b. a compass disposed within said case;

c. a tilt meter disposed within said case; and

d. at least one geophone disposed within said case.

33. The seismic data collection unit of Claim 32 further comprising a seismic data recorder disposed within said case.

34. A method for acquiring seismic data comprising:

a. Providing a self-contained, seismic data collection unit having at least one geophone, a slave clock and a seismic data recorder disposed within a case;

b. Providing a master clock;

c. Synchronizing said slave clock with said master clock prior to deploying the seismic data collection unit;

d. Prior to deploying the seismic data collection unit, initiating operation of the geophones to sense seismic signals;

e. Deploying the seismic data collection unit;

f. Positioning the seismic data collection unit;

g. Utilizing a seismic energy source to generate an acoustic signal to propagate into the earth;

h. Retrieving the seismic data collection unit from deployment; and

i. After the seismic data collection unit has been retrieved, retrieving the data recorded on the seismic data recorder.

35. The method of Claim 34, further comprising the step of stabilizing the unit prior to the step of synchronizing.

36. The method of Claim 34, further comprising the step of initiating data recording of the acoustic signals by the seismic data recorder prior to utilizing a seismic energy source to generate the acoustic signal.

37. A method for recording seismic data comprising:

a. Providing a self-contained, seismic data collection unit having at least one geophone, a slave clock and a seismic data recorder;

b. Providing a master clock;

c. Synchronizing said slave clock with said master clock prior to deploying the seismic data collection unit;

d. Initiating data recording by the seismic data recorder prior to deploying the seismic data collection unit;

e. Deploying the seismic data collection unit;

f. Positioning the seismic data collection unit on the earth;

g. Utilizing a seismic energy source to generate an acoustic signal to propagate into the earth;

h. Retrieving the seismic data collection unit from deployment; and

i. After the seismic data collection unit has been retrieved, retrieving the data recorded on the seismic data recorder.

38. The method of Claim 37, further comprising the step of stabilizing the unit prior to the step of synchronizing.

39. The method of claim 37, further comprising the step of stopping data recording by the seismic data recorder after the seismic data collection unit has been retrieved from deployment.

40. The method of claim 37, further comprising the steps of

a. identifying a time interval beginning after the seismic data collection unit is deployed and ending before the seismic data collection unit is retrieved from deployment;

b. wherein data recorded during the identified time interval is retrieved from the seismic data recorder.

41. The method of claim 37, further comprising the steps of

a. identifying a time interval beginning after the seismic data collection unit is deployed and ending before the seismic data collection unit is retrieved from deployment, wherein said data recorded during the identified timer interval comprises a complete data set for that time interval;

b. dividing the complete data set into data subsets; and

c. retrieving from the seismic data recorder at least one data subset of said complete data set.

42. The method of claim 41, wherein the step of retrieving is carried out multiple times for each complete data set.

43. The method of claim 37, further comprising the step of synchronizing the seismic energy source with the master clock.

44. A method for utilizing a seismic recording unit, said method comprising the steps of:

a. providing a seismic recording unit having a seismic recording device with internal memory media;

b. initiating recording by said device and storing recorded data on said memory media;

c. deploying said unit in a desired location for recording seismic data;

d. continuing to record data and store data on the memory media while the unit is deployed;

e. retrieving said unit from deployment; and

f. continuing to record data following retrieval.

45. The method of claim 44, further comprising the steps of redeploying said unit after retrieval, wherein recording is continued during retrieval and redeployment.

46. The method of claim 45, further comprising the steps of carrying out the steps of retrieval and redeployment multiple time, wherein recording is continued during said multiple retrieval and redeployment steps.

47. The method of claim 44, further comprising the steps of storing said unit after retrieval and redeploying said unit after storage, wherein recording is continued during storage and redeployment.

48. The method of claim 44, further comprising the step of servicing said unit wherein recording is continued during the step of servicing.

49. The method of claim 48, wherein the step of servicing comprises recharging the unit batteries.

50. The method of claim 48, wherein the step of servicing comprises extracting data from said unit.

51. The method of claim 48, wherein the step of servicing comprises synchronizing a slave clock on the unit with a master clock.

52. The method of claim 48, wherein the step of servicing comprises performing quality control tests on said unit.

53. The method of claim 48, wherein the recorded data stored on the memory media is quality control data.

54. The method of claim 44, wherein the step of deploying said unit in a desired location further comprises the steps of

a. Moving said unit to the top of a water column;

b. Releasing said unit into said water column; and

c. Allowing said unit to sink to the bottom of said water column.

55. The method of claim 54, wherein the recorded data stored on the memory media as the unit sinks in the water column is acceleration data.

56. The method of claim 54, wherein the recorded data stored on the memory media as the unit sinks in the water column is orientation data.

57. The method of claim 44, wherein the step of deploying said unit in a desired location further comprises the steps of:

a. Placing said unit on a vehicle;

b. Utilizing said vehicle to transport said unit to a desired deployment location; and

c. Moving said unit from the vehicle to a desired position on the earth.

58. A method for determining the location of a seismic recording unit deployed from a select location, said method comprising the steps of:

a. moving said unit from the select location to a deployment position;

b. measuring acceleration of said unit as said unit is moved from the central location to the deployment position;

c. measuring the orientation of said unit as said unit is moved from the central location to the deployment position;

d. utilizing the acceleration and orientation to determine the deployment location of said unit.

59. The method of Claim 58, further comprising the steps of selecting a starting point location for said unit and utilizing said starting point location in determining the deployment location of said unit, wherein the step of moving begins at said starting point location.

60. The method of claim 58 further comprising the step of measuring the time of acceleration and orientation.

61. The method of claim 58 further comprising the step of recording said acceleration from the select location to the deployment position.

62. The method of claim 58 further comprising the step of recording said orientation from the select location to the deployment position.

63. The method of claim 58 wherein said acceleration is measured in at least three dimensions.

64. The method of claim 58 wherein said orientation is measured around at least three angular axes.

65. The method of claim 58, wherein said acceleration is measured utilizing an accelerometer.

66. The method of claim 58, wherein said orientation is measured utilizing a tilt meter and a compass.

67. The method of claim 58, wherein said orientation is measured utilizing at least three mutually orthogonal gyroscopes.

68. The method of claim 65, wherein said acceleration is measured utilizing at least three mutually orthogonal accelerometers.

69. A seismic data collection unit comprising:

a. at least four seismic data geophones.

70. The seismic data collection unit of claim 69, wherein said at least four geophones are arranged in a tetrahedral configuration.

71. A seismic data collection unit comprising:

a. at least five geophones.

72. A method for measuring seismic data comprising the steps of

a. deploying at least one seismic data collection unit having at least two geophones;

b. utilizing a seismic energy source to generate an acoustic signal to propagate into the earth; and

c. utilizing at least one geophone of said seismic data collection unit to measure seismic data in at least two planes in the x, y, z coordinate unit.

73. The method of claim 72, wherein the seismic data collection unit has at least four geophones and at least three geophones each are utilized to measure seismic data in at least two planes in the x, y, z coordinate unit.

74. A method for utilizing a seismic recording unit, said method comprising the steps of:

a. providing a seismic recording unit having a seismic recording device, a clock and a tilt meter;

b. deploying said unit in a desired location for recording seismic data;

c. measuring the orientation of the unit utilizing the tilt meter and generating orientation data from said tilt meter; and

d. correcting the effects of gravity on said unit clock utilizing the orientation data.

75. The method of claim 74, wherein said step of correcting is carried out while the unit is deployed.

76. The method of claim 74, wherein said step of correcting is carried out in real time.

77. The method of claim 74, further comprising the steps of determining the effects of gravity on said clock.

78. The method of claim 74, further comprising the steps of determining the effects of gravity on said clock based on a particular orientation of said clock.

79. A method for utilizing a seismic recording unit, said method comprising the steps of:

a. providing a seismic recording unit having a crystal clock;

b. generating a crystal aging curve for said crystal clock based on the crystal aging characteristics of said clock;

c. detecting seismic signals;

d. associating said seismic signals with a time based on said crystal clock; and

e. utilizing said crystal aging curve to correct the effects of crystal aging on the time associated with said seismic signal.

80. A method for utilizing a seismic recording unit, said method comprising the steps of:

a. providing a seismic recording unit having a crystal clock;

b. providing a crystal aging curve for said crystal clock based on the crystal aging characteristics;

c. detecting seismic signals;

d. associating said seismic signals with a time based on said crystal clock; and

e. utilizing said crystal aging curve to correct the effects of crystal aging on the time associated with said seismic signal.

81. A method for utilizing a seismic recording unit, said method comprising the steps of:

a. providing a seismic recording unit having a seismic recording device, a geophone and a tilt meter;

b. deploying said unit in a desired location for recording seismic data;

c. measuring the orientation of the unit utilizing the tilt meter and generating orientation data from said tilt meter;

d. measuring seismic data utilizing said geophone; and

e. correcting the seismic data utilizing the orientation data.

82. The method of claim 81, further comprising the steps of:

a. providing said seismic recording unit with a compass;

b. once said unit is deployed, measuring the rotational orientation of the unit utilizing the compass and generating rotational orientation data from said compass; and

c. correcting the seismic data utilizing the rotational orientation data.

83. The method of claim 79, further comprising the step of deploying said unit in a desired location for recording seismic data, wherein said step of correcting is carried out while the unit is deployed.

84. The method of claim 79, wherein said step of correcting is carried out in real time.

85. The method of claim 81, wherein said step of correcting is carried out while the unit is deployed.

86. The method of claim 81, wherein said step of correcting is carried out in real time.

87. A method for monitoring the coupling between a seismic data recording unit and the earth comprising the steps of:

a. providing a seismic data recording unit having at least two geophones;

b. utilizing one of said geophones to vibrate said seismic data recoding unit; and

c. detecting the vibration of said seismic data recoding unit with a geophone other than the geophone utilized to vibrate said unit.

88. The method of claim 87, further comprising the step of deploying said unit in contact with the earth to form a couple therebetween.

89. The method of claim 87, further comprising the step of affixing said unit to the earth to form a couple therebetween.

90. The method of claim 87, wherein the step of utilizing said geophone to vibrate said unit comprises the steps of driving said geophone to produce vibrational energy as an output therefrom by providing an electrical current as an input to said geophone

91. A seismic data collection unit comprising:

a. at least four seismic data geophones, wherein at least three of said geophones are disposed adjacent one another and at least one geophone is disposed in a location removed from said other geophones.

92. The seismic data collection unit of claim 91, further comprising a case in which the at least four seismic data geophones are disposed, wherein said at least three geophones are disposed in said case to maximize detection of seismic energy and said at least one geophone is disposed in said case to maximize vibration of said case by said removed geophone.

93. A seismic data collection unit comprising:

a. a case having a wall defining an internal compartment;

b. a gimbaled platform mounted within the case; and

c. a clock mounted on said gimbaled platform.

94. The unit of claim 93, wherein said gimbaled platform has at least two degrees of freedom.

95. The unit of claim 93, wherein said gimbaled platform has three degrees of freedom.

96. A method for acquiring seismic data comprising:

a. Providing a self-contained, seismic data collection unit having at least one geophone, a slave clock and a seismic data recorder disposed within a case;

b. Providing a master clock and at least one geophone;

c. Synchronizing said slave clock with said master clock prior to deploying the seismic data collection unit;

d. Prior to deploying the seismic data collection unit, setting seismic data collection unit operation parameters within the seismic data collection unit;

e. Deploying the seismic data collection unit;

f. Positioning the seismic data collection unit;

g. Generating seismic data based on a seismic event detected by the geophone in accordance with the operation parameters;

h. Retrieving the seismic data collection unit from deployment; and

i. After the seismic data collection unit has been retrieved, retrieving the seismic data from the seismic data collection unit.

97. The method of Claim 95, wherein the seismic data collection unit operation parameters are set so that the unit records continuously.

98. The method of Claim 97, wherein the step of continuous recording is initiated prior to the step of deploying the seismic data collection unit.

99. The method of Claim 95, wherein the seismic data collection unit operation parameters are set so that the unit records intermittently during specified time intervals.

100. The method of Claim 95, further comprising the step of utilizing a seismic energy source to generate an acoustic signal to propagate into the earth.

101. The method of Claim 95, further comprising the step of initiating operation of the seismic data collection unit prior to the step of deploying the seismic data collection unit.

102. A method for acquiring seismic data comprising:

a. Providing a self-contained, seismic data collection unit having at least one geophone, a slave clock and a seismic data recorder disposed within a case;

b. Providing a master clock and at least one geophone;

c. Synchronizing said slave clock with said master clock prior to deploying the seismic data collection unit;

d. Initiating operation of the seismic data collection unit;

e. Following the step of initiating, deploying the seismic data collection unit;

f. Positioning the seismic data collection unit;

g. Detecting a seismic event by the geophone;

h. Generating seismic data based on the detected seismic event; and

i. Retrieving the seismic data collection unit from deployment.

103. The method of Claim 102, further comprising the step of retrieving the seismic data from the seismic data collection unit after the seismic data collection unit has been retrieved.

104. The method of Claim 102, further comprising the step of terminating operation of the seismic data collection unit after the seismic data collection unit has been retrieved.

105. The method of Claim 102, wherein the step of initiating operation of the seismic data collection unit comprises initiating recording by the seismic data collection unit.

106. A method for utilizing a seismic sensor unit, said method comprising the steps of:

a. providing a seismic sensor unit having a geophone and a tilt meter;

b. deploying said unit in a desired location for detecting a seismic event;

c. measuring the orientation of the unit utilizing the tilt meter and generating orientation data from said tilt meter;

d. generating seismic data based on a seismic event detected by the geophone; and

e. correcting the seismic data utilizing the orientation data.

107. The method of claim 106, further comprising the steps of:

a. providing said seismic sensor unit with a compass;

b. once said unit is deployed, measuring the rotational orientation of the unit utilizing the compass and generating rotational orientation data from said compass; and

c. correcting the seismic data utilizing the rotational orientation data.

108. A seismic data collection unit comprising:

a. a case; and

b. at least one seismic data geophone and at least one additional geophone disposed within said case, said at least one geophone is disposed in a location removed from

said seismic data geophone such that said seismic data geophone is disposed in said case to maximize detection of seismic energy and said at least one geophone is disposed in said case to maximize vibration of said case by said removed geophone.